REMARKS

Claims 1 to 4 are pending in the present application. With this Response, Applicant amends claims 3 and 4.

The Claimed Invention

The claimed invention provides a method to determine a fill style for a pixel untouched by any edges when all of the pixels are only saved with the fill styles of their sub-pixel regions. Thus, the method does not require any additional information, such as the geometrical relationships between the sub-pixel regions and the edges that created the sub-pixel regions.

Specifically, a parameter "sum_fill" (e.g., the recited "first parameter" and "third parameter") is calculated for each pixel. Parameter sum_fill is the sum of the difference between the right fill style and the left fill style of each edge that touches the bottom border of a pixel. A parameter "fa" (e.g., the recited "second parameter") is then calculated for each pixel. Parameter fa is the sum of the parameters sum_fill of the current pixel and the preceding pixels. The fill style of a pixel that is untouched by any edges is set equal to the parameter fa of the adjacent pixel to its right. As can be seen in Fig. 12, each pixel is treated as an object with borders that an edge may intersect.

Applicant has provided a good example described in paragraphs [0145] to [0149] and illustrated Fig. 12 that walks one through the steps of the method. The Examiner may wish to reference the example for a better understanding of the claimed invention.

Inventorship and Requirements to Applicant

The inventors of the claims in application serial no. 10/614,876 are Dongren Chin and Jiangen Cao. The inventor of the claims in application serial no. 10/614,879 is Jiangen Cao. The inventor of the claims in application serial no. 10/614,883 is Dongren Chin. The inventor of the claims in the present application with serial no. 10/614,945 is Shiujin Lu.

The inventorship between application serial no. 10/614,883 and the present application, and between application serial no. 10/614,879 and the present application, is not common because each application claims a distinct and separate invention that originated from the named inventor(s). The inventors were part of a software team working together to design a graphic engine. The inventors

contributed to the graphic engine with the inventions identified by the title of each application and the corresponding heading in the Specification.

Applicant will submit amendments in the pending applications to reference the co-pending applications.

Claim Objection/§ 112 Rejection

As suggested by the Examiner, Applicant has amended claim 3 to depend from claim 2 to provide antecedent basis for the claim elements in claim 3.

§ 103 Rejections

The Examiner rejected claim 1 under 35 U.S.C. § 103(a) as unpatentable over U.S. Patent Publication No. 2004/0207642 ("Crisu") in view of "Computer Graphics: Principles and Practice" by Foley et al. ("Foley et al."). Applicant respectfully traverses.

Crisu

Crisu pertains to an algorithm for matching a coverage mask to a pixel touched by a primitive by storing only a quarter of the coverage masks that would have to be stored in the prior art. Crisu, paragraph [0045] and [0056]. The algorithm accomplishes this by storing only coverage masks for edges in a first pixel quadrant. Id. at paragraphs [0054] and [0059]. Edges in other pixel quadrants are transformed into the space of the first pixel quadrant to be matched with the coverage masks. Id. at paragraph [0054]. Once found, the matching coverage masks are transformed back to space of the original pixels quadrants of their corresponding edges. Id. Once matching coverage masks are found for edges in all four pixel quadrants, the coverage masks are combined into a single coverage mask. Id. at paragraph [0060]. The single coverage mask is then used to determine the color of the pixel for anti-aliasing. Id.

Foley et al.

Foley et al. pertains to various scan-conversion algorithms. From p. 72 to p. 78, Foley et al. discloses a basic incremental algorithm and a midpoint line algorithm for selecting pixels on a raster display that represent a line. From p. 92 to p. 97, Foley et al. discloses a scan-conversion algorithm for selecting pixels on a raster display to represent a polygon.

Determining if each edge touches a bottom border of the first pixel

The Examiner found pp. 74 to 76 and 96 to 97 of Foley et al. disclose "determining if each edge touches a bottom border of the first pixel" as recited in claim 1.

Page 74 of Foley et al. describes a basic incremental algorithm for selecting pixels to represent a line as shown in Fig. 3.5. The algorithm selects a pixel by calculating y_i for each integer x_i of the ideal line and then selecting the closest pixel to (x_i, y_i) by rounding y_i. Foley et al., pp. 73 and 74. As can be seen, the algorithm treats each pixel as a point with integer coordinate and not as an object with borders that an edge may intersect. Accordingly, this algorithm does not determine if an edge touches a bottom border of a pixel because the algorithm treats each pixel as a point.

Pages 74 to 76 of Foley et al. describe a midpoint line algorithm for selecting pixels to represent a line as shown in Fig. 3.7. The algorithm selects between two pixels E and NE by (1) determining a vertical midpoint M between the two pixels, (2) determining on which side of the ideal line midpoint M lies, and (3) selecting one of pixels E and NE based on the result of step (2). Foley et al., pp. 75 and 76. Foley et al. then derives that the selection between the next two pixels can be based on the previous pixel selection. Id. at pp. 76 and 77. This is developed into the algorithm presented in Fig. 3.8. As can be seen, the algorithm treats each pixel as a point with integer coordinate and not as an object with borders that an edge may intersect. Accordingly, this algorithm does not determine if an edge touches a bottom border of a pixel because the algorithm treats each pixel as a point.

Pages 94 to 96 of Foley et al. describe part of a scan-conversion algorithm for selecting pixels to represent a polygon. To fill pixels between a pair of intersections of a scan line and the polygon, the algorithm introduces four rules. Foley et al., p. 94. In the first rule, when approaching a fractional intersection to the right from within the polygon, the x coordinate of the intersection is rounded down. Id. Vice versa, when approaching fractional intersection to the right from outside the polygon, the x coordinate of the intersection is rounded up. Id. In the second rule, when the intersections are at integer pixel coordinates, the leftmost pixel in a span is defined to be interior of the polygon while the rightmost pixel in the span is defined to be exterior of the polygon. Id. In the third rule, when shared vertices are encountered in the parity calculation to determine if a point is inside a region, only the y_{min} vertex of an edge is counted in the parity calculation but not the y_{max} vertex. Id. In the fourth rule, when vertices define a horizontal edge, the bottom edges are drawn but not the top edges through the use of the third rule. Id. As can be seen, the algorithm treats each pixel

as a point with integer coordinate and not as an object with borders that an edge may intersect. Accordingly, this algorithm does not determine if an edge touches a bottom border of a pixel because the algorithm treats each pixel as a point.

Pages 96 and 97 of Foley et al. describe another part of the scan-conversion algorithm for selecting pixels to represent a polygon. To find the intersections of the scan line with all edges of the polygon, the algorithm tracks the x coordinate by incrementing its numerator by ($x_{max} - x_{min}$) at each increment of the y coordinate until the incremented numerator is greater than the denominator ($y_{max} - y_{min}$). At that point, the x coordinate is incremented and the numerator is decremented by the denominator. This is developed into the algorithm presented in Fig. 3.26. As can be seen, the algorithm treats each pixel as a point with integer coordinate and not as an object with borders that an edge may intersect. Accordingly, this algorithm does not determine if an edge touches a bottom border of a pixel because the algorithm treats each pixel as a point.

For each edge that touches the bottom border of the first pixel, incrementing a first parameter by a difference between a right fill style and a left fill style of the edge

The Examiner found pp. 92 to 94 and 95 to 98 of Foley et al. disclose "for each edge that touches the bottom border of the first pixel, incrementing a first parameter by a difference between a right fill style and a left fill style of the edge" as recited in claim 1.

Pages 92 to 94 of Foley et al. describe a scan-conversion algorithm for filling a polygon. As described above, pp. 95 to 98 of Foley et al. discloses additional details of the polygon scan-conversion algorithm. As can be seen, the algorithm treats each pixel as a point with integer coordinate and not as an object with borders that an edge may intersect. Accordingly, this algorithm does not determine if an edge touches a bottom border of a pixel because the algorithm treats each pixel as a point.

As discussed above, the algorithms of Foley et al. pertain to selecting pixels to represent lines and polygons. However, the algorithms of Foley et al. do not provide what style (e.g., color) to paint the pixels. Applicant requests the Examiner to reference the example provided in paragraphs [0145] to [0149] and illustrated in Fig. 12 to gain a better understanding of the elements of claim 1.

For the above reasons, claim 1 is patentable over the combination of Crisu and Foley et al.

Claims 2 and 3 depend from claim 1 and are therefore patentable over the cited references for at least the same reasons as claim 1.

Claim 4 recites similar language as claim 1 and is therefore patentable over the cited references for at least the same reasons as claim 1.

In summary, claims 1 to 4 were pending in the above-identified application. This Response amends claims 1 and 4. For the above reasons, Applicant respectfully requests the allowance of claims 1 to 4. Should the Examiner have any questions, please call the undersigned at (408) 382-0480.

Certification of Facsimile Transmission

I hereby certify that this paper is being facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature Date July 19, 2005

Respectfully submitted,

David C. Hsia
Attorney for Applicant(s)
Reg. No. 46,235